MANUFACTURING CHEMISTS ASSOCIATION

Remarks by Dr. Joshua Lederberg

Water Resources Committee

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There is a need to build new institutions for dealing with environmental problems. The most logical starting point would be direct accommodations among the directly affected parties. The need is dictated by the complexities of society which require survival, respect for human needs, and a political process by which various elements of society seek power. The notion that economic benefits are worth some risk is a political one. In the case of the environmental movement, it is redistributive to gain control over a segment of society. The struggle is at the expense of another segment: those privileged to more technical knowledge and capital.

There is not much reason to be optimistic about trends in this matter because symbolism keeps getting out of proportion to substance. Incidents such as kepone will keep arising and might as well be anticipated as probable incidents in an imperfect world.

With regard to chemicals in the environment, a dilemma is presented. Society, through government regulation, needs to protect itself but does not know to predict long-term effects with certaintude. Animal testing is but one of a battery of current fads to get through the regulatory process, yet is the only means available and is seriously deficient. For example, there is no way to assess behavioral side effects or that chemicals in small doses do not alter behavior. Only one substance at a time can be tested and that is compromised by insufficient analytical methods and instruments. The result is that there isn't any way to predict a threshold tolerance level. By way of example, distilled water would be free of chemicals, but would lack desirable trace elements. They would have to be added. Immdeiately, the question of additives arises in terms of how much of which ones are "safe."

In the field of water sanitation, there is a crying need for fundamental work on "what is wrong with carbon adsorption?" It may generate more problems that it solves. Likewise there is a need for deeper understanding of alternatives such as ozonation or radiation. For example,

ozonated water in combinations with organics adsorbed on carbon would yield interesting compounds.

Biological testing should be a highly suitable route for understanding long-term mutagenic or carcinogenic effects. Bacterial genetic tests such as the "Ames" test, afford several advantages. First, the DNA chemistry in bacteria is the same as in human cells. Second, one billion cells can be tested overnight. Third, biological amplification is achieved, so that changes in a single molecule can be discerned. If there is incomplete metabolism of hydrocarbons in the body, intermediate hydroxylated carbon compounds are formed, which is a basis of mutation. Mutations are a necessary step in all cell misbehavior, e.g. sarcomas, but there also is an immunological system to police aberrant cell behavior. Events, such as colds, may weaken thatprotective mechanism and allow somatic damage.

Genetic mutation shifts take about 10 generations on the average. Consequently, each of us carries around some 300 years of cumulative genetic modification. The tools to understand this, being only five years in being, are unsuitable to detect trends. However, we know that it is impossible to demonstrate permanent genetic effects from the

atomic bombs exploded at Hiroshima and Nagosaki.

A global system for making toxic risk assessments is possible, but there must be absolute, not inferential, tie points between its elements. It is useless to have clinical data without epidemiological evidence, or vice versa. Threshold models, involving bacteria, animal, and human observations can be employed, even if overdosing is the only extrapolative basis available. The effects of chemical substances can be predicted by their reactivity with amino acids, of which sixteen form the basis of protein and are intrinsic in the DNA molecule.

However, the exposure paths also must be considered. Barriers between the source of the substance and the individual cell are multi-fold and varied. Thus, results based on individual cell chemistry must be tempered.

In order to come to grips with the problem, Dr. Lederberg proposed several courses of action. First he wishes to meet with people who can work with him on economic risk/benefits. The university is an unsuitable institutional mechanism for this. Second, he believes there is a need to support training of science majors in the business of assessing economic benefits and risks as seen from a commercial point of view and in the context of constraints imposed by regulations

people, logistics of supply and demand, corporate interests and shareholder requirements. Third, he invites direct meetings to develop a forum on means of communication without government moderators, participation, or intervention.